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Museum, Register, Journal and Gazette.

Come, bright Improvement! on the car of Time,
And rule the spacious world from clime to clime;
Thy handmaid Arts shall every wild explore,
Trace every wave, and culture every shore.——*Campbell.*

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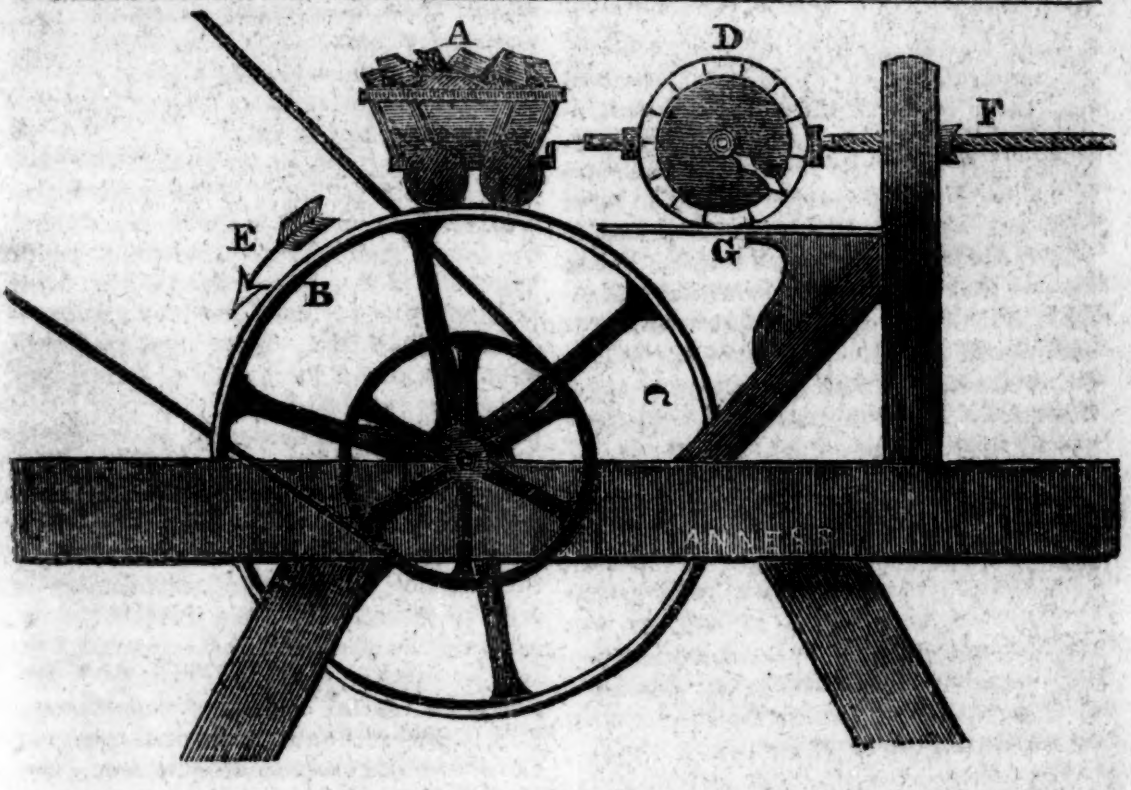


From the Manchester Guardian.
(English Paper.)

EXPERIMENTS ON FRICTION—RAIL ROADS.

Numerous and extensive projects lately started, for constructing railways in different parts of the kingdom, have directed a large share of public attention to the subject; and it has become more generally interesting from the publication, in a newspaper of a high scientific character, [*The Scotsman*] of a series of papers which have been very generally read and commented upon, but, as it appears to us, by no means universally understood. The object of those papers was, in a great measure, to show the (practicability of transporting commodities upon rail roads, at a very considerable speed; and (with some fallacies, which we shall endeavour to point out) they contain a great deal of valuable information on the relative merits of highways, canals, and rail roads. The principal point, however, and the one to which we shall confine our observations, is an enunciation of the laws which regulate the friction of rolling and sliding bodies, as deduced from the experiments of Vince and Coulomb. With a view to the illustration of this part of the subject, some very important and conclusive experiments have recently been made in this town, to which we shall by and by have occasion to refer at some length; but before doing so, we must make a few observations on the rule laid down in *The Scotsman*, and the misconceptions which appear to have prevailed respecting it, both in that journal and in other quarters.

After comparing the resistance experienced by a boat moving through the water, with the friction which retards the progress of a wagon on a rail road, and stating that they are governed by different laws, *The Scotsman* notices the conclusions established by the experiments of Vince and Coulomb; the most important of which is, that *the friction of rolling and sliding bodies is* THE SAME FOR ALL VELOCITIES. The writer then observes:—

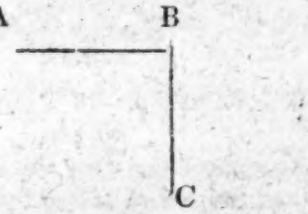
[As the passages here introduced have been already given in this *Magazine*, we need not repeat them; but refer the reader to our publication of April 16th, pp. 163, 166, for an abstract of the conclusions established by Vince and Coulomb, and also to eight lines of the subsequent paragraph, beginning with the words "Now it is atall times easy" and concluding with the words " or arms of the sea."]

Now we are perfectly satisfied, both by the experiments of Vince and Coulomb, and those more recent and more conclusive experiments, to which we have already alluded, that the rule laid down here is correct; but the writer ought to have guarded against the misconception to which his last paragraph is liable. When he says that a high velocity would cost almost as little as a low one, he should have said that it would cost as little *per mile*—or as little over any given space; for it cannot be his meaning, that a carriage can be kept moving *for an hour*, or for any given *time*, at a high velocity, with as little expenditure of power as at a low velocity. Yet this he has been generally understood to mean, and a great deal has been written and said with a view of proving that he was mistaken; when, in fact, he was only misunderstood. In a subsequent article, however, the writer appears to have in some degree fallen into the error in which he has led other persons.

He says:—

"Every body knows that the rate of stage coach travelling in this country has increased within the last twenty-five years, from six or seven miles an hour, to eight or nine, and this too before roads were M'Adamized, and with much less injury to the horses than was anticipated. Supposing that a coach horse could run fourteen miles unloaded, with the same muscular exertion which carries forward the stage coach at eight or nine miles, then Professor Leslie's formula becomes $\frac{3}{4}(14 - v)2$. Each horse would, of course, draw with a force of 48 pounds at six miles, and of 27 pounds at eight miles an hour. But if the friction increased in the ratio of the velocity, the load upon each horse would increase from 48 to 60 pounds, when the speed increased from six to eight miles an hour; and as the horse exerting the same strength, would only pull with a force of 27 pounds, he would thus have more than double work to do—which is plainly impossible. But admit that the friction is equal in equal times; then, since the time is diminished one fourth, by increasing the speed from six to eight miles an hour, the horses have actually one fourth less to do; the load upon each is reduced from 48 pounds to 36, and the horse would have to increase its exertion only one third; that is, from 27 pounds to 36. The facts, we believe, will be found strictly consistent with this hypothesis, and decidedly at variance with the other. However strange it may sound, then, to common observers, it is practically true, that *a smaller absolute amount of force* will drag a coach *over the same space in three hours than in four, and in one hour than in two.*"

This paragraph seems to us to contain a very obvious fallacy. If the speed be increased from six miles an hour to eight, the horses have by no means one fourth less work to do, supposing the friction a constant quantity, and the traction consequently the same. It is true that they exert this power for a shorter time, but it is *over the same distance.* Supposing the power of traction necessary to overcome the friction is 100 pounds, then that power must be exerted over every yard of the distance, whether the carriage moves at six or eight miles an hour; and it is by the distance, not the time, that the power must be measured. That this must be the case, will be obvious if the experiment be put in another shape. Suppose a perfectly horizontal railway, a mile long, with a perpendicular descent of a mile at one end of it, as represented on the following diagram.



Suppose a wagon placed on this railway at A, attached to a rope passing over a pulley at B, and loaded at that point with a weight exactly sufficient to overcome the friction, then, if the resistance of the air is nothing and the rope be without weight, it follows, from the rule laid down, that if the wagon is set in motion at any given speed, it will continue to move at that rate until it reaches the point B, and the weight falls to C. But whether the wagon passes over the railway in an hour or in three minutes, it is obvious that the same weight will descend through the same space, and that, consequently, the same *amount* of power will be expended. It is, perhaps, necessary to observe here, that if the weight is only *just sufficient* to overcome the friction, there will

(as is proved by the experiments of Mr. Vince) be no acceleration of motion on the principle of falling bodies.

However, though a carriage cannot, as we think we have shown, be moved ten miles in one hour, with a *smaller* expenditure of power than in two, it is very interesting to know that it can be moved with *the same* expenditure (excepting always the additional resistance of the air.) In many cases despatch is of so much consequence, that the elucidation and application of this rule will probably lead to very important results. Many persons, however, are very sceptical on this subject, and contend that the experiments of Vince and Coulomb do not authorise any such conclusions as have been drawn from them. It has been asked, if the same constant force will move a carriage as well at a high as at a low velocity, why we do not see something like this in practice? why a carriage moved by a steam-engine, instead of acquiring, as it proceeds, a high degree of velocity, moves on at one uniform rate after it has overcome the *vis intertiæ* at the commencement of its journey? We think the reason is very obvious. A locomotive steam engine does not exert the *same constant force* on the peripheries of the wheels of the carriage, when it moves at different velocities. For instance, suppose the piston of an engine to move 220 feet in a minute, and to impel the peripheres of the travelling wheels at a velocity of two miles, and with a force just sufficient to overcome the friction—how can the speed be augmented without increasing the power of the engine? If the diameter of the wheels be increased, with the view of increasing the speed, the force with which they are impelled will be diminished in the same proportion; and the engine will stop unless the pressure is increased. To increase that, of course, will be to augment the power. As it is obvious, therefore, that a steam engine cannot exert the same force at different velocities, some other means must be devised for putting to the test of experiment the rule laid down in the *Scotsman*.

We now come to the most important and interesting part of this article. As none of the experiments of Vince or Coulomb (so far as we have seen or heard them detailed) were made with bodies resembling rail-way wagons, either in form, or in the nature of their motion, the correctness of the conclusions deduced from them, with respect to such carriages, was doubted by many persons of considerable scientific attainments. It became desirable, therefore, that other expriments should be tried, with carriages, upon rail-ways, which, of course, would be much more satisfactory. This, however, it did not, at first sight, appear very easy to accomplish in a satisfactory manner: but Mr. Roberts, of this town, recently devised a mode of determining the point, which appears to us wholly unobjectionable, and which exhibits, in a high degree the simplicity and facility of execution, by which that gentleman's inventions are so eminently distinguished. It was very difficult to devise means for measuring accurately the friction of a carriage moving over a rail-way; but it occurred to Mr. Roberts, that the difficulty would be obviated if the rail-way were made to move under the carriage. When this idea once presented itself, it was easy to reduce it to practice. Mr. Robers, therefore, constructed an apparatus, of which the annexed engraving will give a pretty correct notion:

Description of the Engraving.

A is a small wagon with four cast iron wheels placed on the periphery of a cast iron drum, B, three feet in diameter, and six inches broad, (which acts as the rail road.) This drum is fastened on the same shaft with the pulley C, which is driven at different speeds by a strap from another pulley. The wagon is attached by a wire to one of Marriott's patent weighing machines, D, for the purpose of measuring the friction, and the board, G, prevents the current of air, occasioned by the motion of the drum, from acting upon the carriage. Now, if the drum be driven with any given velocity, say four miles an hour, in the direction indicated by the mark E, and the wagon held in its place by the wire which attaches it to the index, it is perfectly obvious that the wheels will revolve on the drum in precisely the same manner as if the wagon moved forward on a horizontal road; and the friction will also be the same, except, perhaps, a small addition occasioned by the curvature of the drum, but which will not affect the *relative* frictions of the different speeds. As the wagon is stationary, the resistance of the air will be entirely got rid of; and the index of the weighing machine will indicate the precise amount of traction necessary to overcome the friction. Of course, in making the experiment, it will be necessary to keep the centre of the wagon *exactly over the axis of the drum*; for if it were permitted to go beyond the centre, a part of the weight would be added

to the friction; if, on the contrary, it was brought nearer the index, a part of the weight would act against the friction, and diminish the apparent quantity. The tempering screw, F, is, therefore, added to keep the wagon in its proper situation, in whatever way the spring of the weighing machine may be acted upon by the friction.

This simple apparatus having been constructed, a number of experiments were made, chiefly with a view to determine whether the friction was the same at different velocities. The wagon was loaded with 50 pounds, (including its own weight) and the drum was driven at different velocities, varying from *two to twenty-four miles an hour* on the periphery: but in every case THE FRICTION, as indicated by the weighing machine, was *precisely the same.* No increase of speed affected the index at all, but on increasing the *weight*, it immediately showed a corresponding increase of friction.

We consider these experiments as perfectly conclusive of the fact—that the friction on a railway is the same for all velocities; and that a carriage may be propelled twenty miles in one hour, with the same amount of force which would be necessary to drive it twenty miles in ten hours, provided the resistance of the atmosphere was out of the question: and, if the carriage was properly constructed, *that* would not amount to much. In other words, goods may be conveyed from Manchester to Liverpool, on a rail road, with very nearly the same expenditure of steam, whether they are carried two miles, or four miles, or twenty miles an hour.

A steam engine, which will propel 20 tons at four miles an hour, will, with the same expense of coals, propel 10 tons at eight miles an hour; so that, with the smaller load, it might make a journey to Liverpool and back, in the same time which would be occupied in going thither with the larger load. Or, to put the matter in another shape; suppose a four-horse engine will convey 40 tons to Liverpool in eight hours—an eight-horse engine will convey the same weight thither in four hours. There will be the same expenditure of steam in both cases, but, in the latter a *saving of half the time;* a saving which, we need not add, will frequently be of immense importance.

Mr. Roberts also tried some experiments to determine the rate of friction, and the relative frictions of different weights: but as these experiments will probably be repeated with greater care and accuracy, we shall at present abstain from farther notice of them.

NEW VOLTAIC MECHANIC POWER.

From the London Chemist.

That the powerful agent, Voltaic electricity, is speedily destined to pass from the laboratory to the workshop, is not disputed by any person with whom we have conversed, or from whom we have heard on the subject, It is admitted to be applicable as a mechanic power; but the suggestion is so novel, that no experiments have yet been instituted to ascertain its advantages. All the mighty effects in nature of what is called electricity are not known to us; but that it is the active agent in most of the changes of the atmosphere, and in producing many other important phenomena, is clearly established; and by borrowing it, therefore, we may expect in time almost to equal, by our labours, some of the minor but stupendous works of Nature. It was an observation of that illustrious man, Lord Chancellor Bacon, "That man can only subdue nature by obeying her laws;" and in the same manner we may say, that man can only hope to equal her operations by working with her instruments. The connexion betwixt common electricity and *Voltaic* electricity is clearly demonstrable, and the connexion between, or rather the identity of, common electricity and lightning has been long known and admitted. Thus we have, in the Voltaic battery, manifested, indeed, by some unexplained causes, but manifested in such a manner as to be perfectly at our command, the same agent which hurls lightning through the sky, and which is so terrific, that, till science explained its origin, it was considered as an indication of the ire of an avenging Deity. It is this agent which we stated in our last Number might be introduced into use as a mechanic moving power, and of which we then promised some farther developments.

The objections stated to our proposal amount in substance to two, The first is, that the expense of generating a sufficiency of the two gases will be so great, in proportion to the quantity obtained, that it can never be so economic a power as steam. The value of this objection amounts to this:—Coals are now comparatively cheap in England, and copper, zinc, and sulphuric acid, comparatively dear. But there are countries and situa-

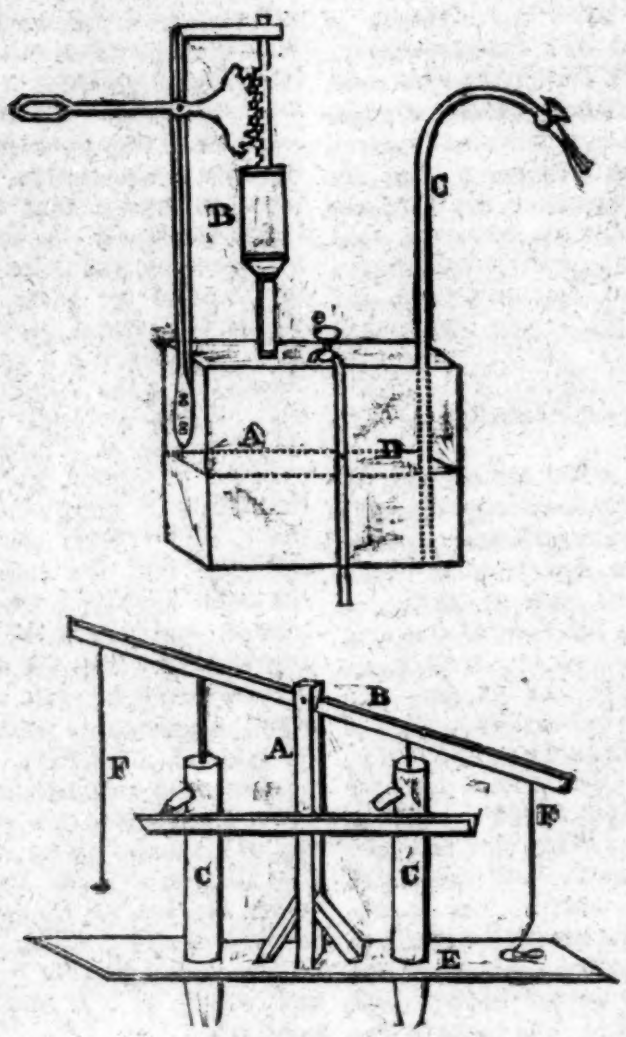
tions in which fuel is scarce and dear; and in such it may be advisable to think, at least, of a Voltaic mechanic engine.—But those who make this objection are quite in the dark as to the quantity of the gases generated by a Voltaic battery; no experiments, in fact, have ever been made to ascertain what quantity of gases are produced with a given Voltaic battery within a given time. This is a point we mean to ascertain, but have not yet been able. We may observe, however, that the quantity we may produce will always depend on the size of the instrument, and extent of the metallic surface exposed to the action of the acid; and if we choose to add to the number and size of the plates, we may decompose an indefinite quantity of water.

The expense of a Voltaic battery, according to the charges of the philosophical and mathematical instrument-makers, about town, is, for each trough complete, containing ten pair of plates, of four inches square, the size of those at the Royal Institution, on Dr. Wollaston's plan, 2*l.* 4*s.*; making the expense of a battery of 400 pair of plates 88*l.* By the ordinary method of connecting the plates, such a formidable battery will cost, for each trough of ten pair, 1*l.* 14*s.*; making, for the whole, 68*l.* With the ordinary wear of such a battery, it is calculated that it will last two years. Let us suppose that ours will be more frequently in action, and will last one year; then the capital required for such a battery will be only 88*l.* per year. The troughs also do not wear out like the metals, and therefore want no renewing. They cost 10*s.* each. The acid employed costs about 3*d.* per lb., buying it from the dealers in London. The proportion recommended by Mr. Brande is 1 lb. of acid to 60 lbs. of water; and supposing it takes 20 lbs. of this liquid for each trough (consequently one-third of a pound of acid,) and that the acid requires to be renewed once every day, we shall have for the daily expense of the acid 3*s.* 4*d.* The labour of managing this part of the business will be a mere trifle; and as the mode of operating will produce almost a perfect vacuum, we say, that for the daily expense of 3*s.* 4*d.* and a capital advanced of somewhat less than 100*l.*, we may get a very considerable power: the cost of its application is another thing, and must be decided by other principles.

In this estimate of the expense of a Voltaic battery, it must be recollected, that we have taken the price which philosophical instrument-makers, who are men of talent and ingenuity, and are paid accordingly, charge for these things; and that the article they supply is finished with great neatness and care. For Voltaic batteries to produce a mechanic power, we should go the cheapest and most economical way possible to work. Taking this into consideration, we have no hesitation in saying, that whenever Voltaic batteries should be articles of regular manufacture, and there were a considerable demand for them, that their price would be reduced more than one half.—In our opinion, it is a considerable recommendation of the Voltaic mechanic power, that all the materials which go to produce it are, in a great measure, the product of labour, and will get cheap as that labour is more efficient.——Another thing, also, which requires to be observed is, that the copper and zinc and the acid employed would not be annihilated, and might be recovered; consequently, the expense of supplying these articles would be little more than the expense necessary to recover them after being used. We have, in fact, decomposition and recomposition, both of the water from which we procure the gases, and of the materials by which we decompose that water; and the power we actually employ, or consume, is only that immaterial agent which is made manifest on the decomposition and recomposition, and which, as it is measureless, is inexhaustible.

Even if it should turn out that galvanic electricity, employed to decompose water, and inflame the gases, is an expensive way of getting power where fuel is cheap, a point, however, which is not ascertained, for nobody has made any experiments concerning it, the suggestion may still be of great utility where fuel is dear, or where it cannot be procured. Even where it is cheap, a Voltaic mechanic power may still have some recommendations.—The space into which it may be put is small; it emits no smell, and sends forth no smoke; it will annoy nobody, and never be a nuisance; it does not depend for its operations on the elements; the materials necessary for it are all easy of carriage; and it may thus perhaps serve to equalize the gifts of Nature, and liberate industry and the arts from the fetters of local restriction. The other objection, which applies to working explosive engines, which a Voltaic mechanic engine will be, shall be considered in a future number.

RAISING WATER.



SIR,— I send you a Plan for Raising Water, which I think will answer the inquiry of your Correspondent J. B. B.

A is a strong cistern, B an air-pump for forcing air into A. C is a pipe soldered into A, reaching within an inch of the bottom. D is a pipe which supplies A. When it is about three parts full, it must be turned off at *e*. The reservior is pumped as full of air as possible, by means of the air-pump, B. The water will then be forced through C as high as wanted.

I am, Sir,
Respectfully yours,
P. VANRYDE.

Why not force in water instead of air with a common forcing pump? Under this modification, the vessel A being partially filled with air, the supply and stream of water through the pipe C would be constant.— AM. ED.

I have also sent you a plan of two Pumps, which I have frequently seen working in Holland.

A is an upright piece fixed in the platform E. B, a cross piece, working in a groove made in A, and attached to the suckers of the pumps, C, which are worked by two lines, F. D, a trough to carry off the water.— Thus two men can raise an immense quantity of water in a day, as there is a constant stream from one or other. P. V.

SAFETY FOR THE DEAD.

SIR,—A Correspondent, under the head of "Safety for the Dead," recommends the placing a pound of gunpowder in the coffin in some detonating medium; so that, upon the removal of the lid, an explosion may take place, and the persons near it be destroyed.

He writes upon a subject which he does not contemplate *in all its bearings*. Medical students must have subjects, or they must be turned upon the public ignorant of their profession; as it is well known to all surgeons, that neither plates nor models will answer the end proposed.

A body already costs sixteen or eighteen guineas, and were T. A. P.'s plan put into practice, they would be at double the money, from the increased risk. As to preventing the practice, that is impossible under the present system.

In Paris you never hear of a grave robbery, and for this plain reason: the bodies of paupers, and unowned persons may be procured for a few shillings (francs) by proper application; and the French surgeons are, in consequence, able anatomists and clever practitioners.

The contrast between them and our half-educated young men was strikingly exemplified in the beginning of the last war. The French soldiers were attended by men who had dissected, and our unfortunate fellows often fell into the hands of those who had *not* dissected: the consequences are obvious. Look at the state of medical science in Turkey and Russia, where dissections are not permitted, and let me ask T. P. A. how he would like to be obliged to submit to an operation or replacing a dislocated limb, by one of their surgeons? It is a notorious fact, that the wounded Russians immediately surrendered to the French, on purpose to be placed under the care of the French surgeons.

Of two evils, sir, it is wise to choose the lesser; and unless T. P. A. will induce our legislature to adopt the Parisan plan, it is better that graves should be robbed, than the living mangled, and absolutely murdered, by ignorant surgeons.

I am, Sir, yours, &c.

SAFETY FOR THE LIVING.

Bristol, Nov. 13, 1824.

THE STEAM GUN FOLLY.

The letter of the "Gun Sponger," given in our last Number but one, showed very clearly the erroneousness of the statements which have been recently put forth by Mr. Perkins and his friends respecting the superior powers of steam, as compared with gunpowder, in propelling shot. It now turns out that the invention is not only useless, but has been repeatedly tried before, and failed. General Chasseloup proposed the employment of steam guns for the defence of places in 1805; and Mr. Watt, as stated by Veritas, tried the experiment long before. It is also a fact, that Hornblower, thirty years ago, constructed a steam rocket, though this is not generally known. General Chasseloup, however, seems only to have had a notion of such a thing, and to have formed no definite plan on the subject. In 1814, M. Gerard, an officer of Engineers, constructed a weapon of this kind. The boiler was moved on a carriage, and supplied steam for six gun-barrels, the *breeches* of which *could be opened at pleasure*. On turning a handle, the six barrels recived a ball and the steam at once. The longest shots were made by turning the handle slowly, and 180 balls were thrown in a minute. Two cassoons attended the machine with fuel and bullets. A certain number of these instruments were made for the defence of Paris, but were destroyed on the allies entering that city in the abovementioned year.

The application of steam in this way, even on the high pressure system, is found, on experiment, to be only substituting a *less* for a *more* effective instrument. The following explanatory observations on the subject we extract from *The Chemist*.

"The expansive power of water compared to that of gunpowder is, perhaps, on the whole, greater; but,

in first of all converting it into steam before it is used, the larger part of that expansive force is destroyed.—If a drop of water get within a mould in which metal is to be poured, its expansive power is so great as to scatter the whole mass; but, by the application of heat to water, in a certain free space, this power is diminished in proportion to the size of this space. Now, first to heat and then to boil water, is a great loss of this power; and, as Mr. Perkins has not compressed steam so as to make it manageable beyond 500 atmospheres, while the explosive force of gunpowder is more that 1000, it is plain that his invention substitutes a less for a greater power. If, however, the *facility of loading* and discharging the piece, which belongs to the steam gun, and is its distinguishing excellence, could not be imparted to the powder gun, the steam might be preferable This, however, does not seem to be an impracticable problem. With the present perfection of our mechanical instruments, and our skill in casting, it seems not impossible to make powder guns which shall be loaded at the breech. When this is effected, powder will be assuredly superior to steam. Nor does it seem impossible to make a gun which shall be connected with a reservior both of powder and balls, and by means of a mechanical contrivance to have a certain quantity of this powder and a single ball propelled into the chamber of the gun, and discharged at any given rate. We take no delight in instruments of destruction; but we recommend those who do, rather to turn their attention to the mechanical improvements of which powder guns may be susceptible, than to have recourse to steam. The principle of all improvements must be to load the gun at the *breech*."

METHOD OF PREPARING SODA WATER.

Soda Water is prepared (from powders) precisely in the same manner as ginger beer, except that, instead of the two powders there mentioned, the two following are used:—For one glass, 30 grains of carbonate of soda; for the other glass, 25 grains of tartaric (or citric) acid. The powders should be dissolved in water, in separate glasses; these mixed and instantly drank.

THE PATENT STAY-SAIL, INVENTED BY SIR HENRY HEATHCOTE, R. N.

Every attempted improvement of navigation, however relatively trifling, assumes an adventitious importance from the main object of the science, viz. a safer, more rapid, and more frequent communication between the several parts of the earth. The vast increase of commerce, the almost equally wide-spread of travelling, and the general growth of intellectual and literary information have arisen from a communication between sea-divided lands, through the medium of navigation; and in their turn have, by a sort of reciprocal operation severed to improve the science itself, and so to facilitate the grand design, viz. a frequency of social intercourse between distant communities.

Of the nautical inventions of modern times navigation by steam stands proudly pre-eminent. It is the most important improvement of science since the discovery of the magnet, and would alone be sufficient to mark the age of its invention as an era in philosphical speculation, as well as in practical improvement. After it every alteration, however ingenious or useful, in the management of sails, must sink into insignificance, when compared to an invention which bids fair, in the course of time, to supersede the use of sails in toto. But till that period of the perfection of the discovery, and while navigation by sails continues to be so universally acted on as it is, and in ships of war must be, so long every suggested improvement in the shape, size, or management of them must continue to demand that attention and deserve that praise, which is due to every attempt to increase the frequency and facility of social intercourse between the separated masses of the human race.

With these sentiments of the general utility of navigation, we took up Sir Henry Heathcote's Treatise on

Stay-sails, from which we shall quote a few extracts to illustrate our subject. It may be necessary to premise for the information of our dry-land readers, that Stay-sails are those sails situated principally between the masts, for the purpose of intercepting such wind as may escape the square sails affixed to the masts; the form of them is quadrilateral. Sir Henry Heathcote has considered that trilateral stay-sails would be less injurious, and bring more positive advantages than the old quadrilateral ones. His conviction of this position has been so strong that he has reduced it to practice by designing stay-sails of the trilateral shape, and even by taking out a patent for "his invention of the improvement of the stay-sails generally in use."

The gallant Captain remarks:

"The object I have in view in the organization of my patent sails is, to abolish quadrilateral stay sails. 1. On account of the injurious lateral pressure of the upper triangle thereof, destitute of any direct impulse; an action which can only tend to increase the ships lee-way, and distress the masts and rigging. 2. Of its perniciously obstructing a large quantity of wind from the square-sails, and thereby proportionably depriving them of their power. 3. Because sails thus constructed do not (generally speaking) intercept so much of the wind passing between the square sails as might be intercepted; 4. Because, on account of their superfluous magnitude, their weight together with the simply lateral pressure of the wind on their upper triangle before alluded to, contribute to prevent their being carried with that degree of safety, they otherwise might, particularly in squally weather, when it is extremely difficult to haul down and stow them."

After thus stating his objections to the old Stay-sails, he adds:

"I have been favoured with the opinions of old seamen of every class, among whom I might enumerate some of the most distinguished officers in the navy, and of the highest respectability in the Honourable East India Company's service, all of whom agree in reprobating the old stay-sails, 'as of no use except a few points of the wind;' and many of them declare 'they never allow them to be bent in the ships they command;' and an old naval officer informs me that the upper stay-sails on the mizen-mast are generally discontinued through the navy."

On the utility of properly formed stay-sails, Sir Henry observes:

"Stay-sails between the masts are more useful by the wind, than any other point of sailing, provided they are shaped and placed on scientific principles, and this from three causes:—First, when by the wind, and only then, they trim at a better angle than the square sails:—Secondly, on that point of sailing, their useful or clear interception bears the greatest proportion to that of the square sails:—Thirdly, the direct or longitudinal impulse of stay-sails, when trimmed at 25 degrees with the keel (as should be the case when the ship is close hauled) is more horizontal than when the sheet is flowing; but the old stay-sails with their immense proportion of simply lateral pressure on the upper triangle, its great obstruction of wind from the square sails, and, in some instances, the disproportionate weight of them, certainly do more harm than good, except a few points of the wind when the hauling the tack over to windward, in a great measure relieves the ship from the simply lateral pressure of the upper triangle, or that it thereby becomes nearly innoxious, and no longer operates materially as a deduction from the useful impulse afforded by the lower triangle; still, however, the upper triangle does no good beyond the interruption of a small quantity of wind under the feet of the square sails, which is not more than equivalent to the loss of direct impulse, arising from the impossibility of trimming the said triangle, even with the wind at large, at quite so favourable an angle as the square sail immediately, which suffers therefrom an obstruction of wind proportioned to the magnitude of all that part of the said upper triangle which

is before the line of interception by the square sail; but the new sails, inasmuch as they never exhibit any decidedly pernicious obstruction of wind from the square sails, and produce more useful interruption of wind than the old ones, are superior to them, even with the wind large, and by the wind, infinitely so, as the upper triangle of the the old sail is on that point infinitely mischievous."

On the utility of stay-sails in general, Sir Henry continues:

"It is evident that a great deal of wind passes between the square sails (particularly the upper ones) both of the fore and mizen masts, and of the main and mizen masts, which might be rendered highly conducive to the velocity, steerage, and manœuvre of the ship, could it be intercepted by sails, every part of which trims at a proper angle, and which do not in any way deteriorate the square sails. It will, therefore, be my care to prove, incontrovertibly, that such are the transcendant qualities of the new ones I have invented, which are divested of the objectionable part of the old ones, and are made to trim on the same principle as jibs, which are found to be very drawing sails."

Of the importance of light sails in giving increased velocity to the rate of sailing, we have the following practical instance from a naval officer, an acquaintance of the author.

"It happened to him, when employed in the Mediterranean, to witness the capture of great part of an English convoy by a French squadron, when several of the Smyrna traders escaped, entirely from being better found in light sails than the vessels which were taken."

The arguments on the importance of stay-sails in intercepting light breezes, which would otherwise escape between the square sails, are wound up in the following:

"In a word, the action of light airs on stay-sails may be justly regarded as frequently imparting an impulse which, but for the stay-sails, the ship would not have received; by means of them one light air may shoot the ship into another, which may advance her to a stronger and more extensive one, whereby she may progressively reach a regular breeze; and I do not hesitate to affirm, from my own actual observation, that properly organized stay-sails between the masts, besides tending to increase velocity in light weather, may essentially assist in shooting a ship, when she would otherwise have been motionless, and (regarded as the primary and inductive impulse) not improbably be the means of enabling a ship near the shore to keep off it, or (as may be desired) either to force or avoid an action."

Having shown the importance of properly shaped stay-sails, and the injury caused by the quadrilateral stay-sails now used, the gallant Captain proceeds to demonstrate the advantages of his trilateral patent ones.

"That the new sails are properly organized cannot be reasonably denied;—as, First, they are both proportioned and placed (according to the exigencies of the case) so as to produce the greatest possible non-obstructing interception with the least possible obstruction of wind.—Secondly, Every part of them trims at that angle which is most conducive to the headway of the ship.—Thirdly, Whilst the wind remains light enough for auxiliary sails to be useful, these may be carried without deteriorating the action of the square sails."

"The trilateral stay-sails, instead of having their tacks (like those of the old sails) all reaching forward to the foremost of the two masts between which they are set, shall have their tacks variously situated in that respect, extending from the mast farther, or less far (or in some instances reaching close forward) as may, according to the actual dimensions of the masts and yards of the vessels for which they are designed, and their several distances asunder relatively, be found most conducive to the object of increasing the interception of wind passing between the square sails to the utmost extent, consistent with a due regard to their being so proportioned as to admit of their being easi-

ly managed in manœuvring, and to leave sufficient spaces between them and the square sails abaft them, to prevent the wind defluted by the former from materially affecting the latter."

The advantages to be derived from the adoption of the new sails are thus summed up:

"First, By abolishing the longitudinal triangle to relieve the ship incalculably from simply lateral pressure, tending only to endanger the masts, and increase the lee-way; and from a not less pernicious obstruction of wind from the square sails. Secondly, By the new method of setting and proportioning the stay-sails, to intercept a greater quantity of wind passing between the square sails, than is intercepted by the useful part of the old sail. Thirdly, And to save a considerable quantity of csnvass. Fourthly, The new sails may be managed, taken down, and stowed more easily than the old ones."

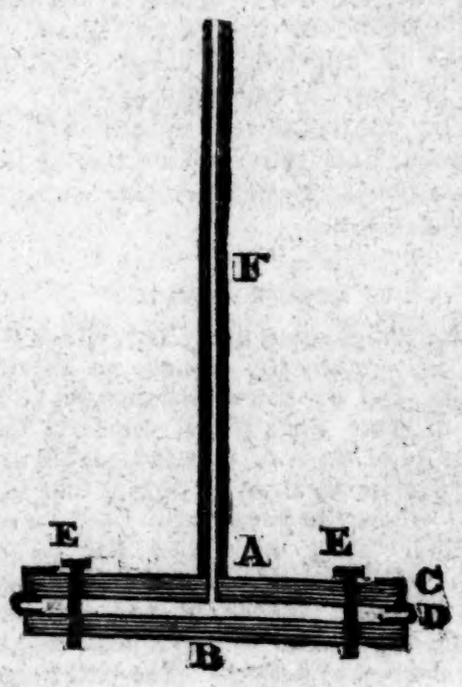
In our notice of this Work our object has been to explain the nature of the subject, and to arrange the arguments in a manner which may render them intelligible to the general reader. Of the superiority or inferiority of the proposed improvement over the sails now in use, we will not presume to advance a positive opinion: first, because the arguments cannot be tried by scientific principles alone, so general and certain as to allow a moral conviction of their infallible truth: secondly, a capability of estimating them with any degree of correctness could have been acquired alone by such an intimate knowledge of the nautical details and professional technicalities (particularly of the action of the wind on sails) as a long life of seamanship and most attentive personal observation alone could bestow: thirdly, because the mathematical calculations and scientific principles, however correct in themselves, must in their reduction to experimental practice, be liable to so many modifying circumstances and thwarting difficulties, as to render a prompt and infallible conclusion on the first or even fiftieth experiment a thing of incalculable improbability, if not of ultimate impossibility. The elementary nature of our publication, and the size of the extracts already made, prevent us from giving any of the mathematical calculations; to nine-tenths of our readers they would, perhaps, be uninteresting. They are, however, very correct. We shall feel happy if the notice of Captain Heathcote's invention in our record of mechanical transactions shall help to extend the knowledge of it to quarters where abstract science or practical observation may be thus roused to throw their lights on any side of the question.

We almost forgot to mention that the Work is dedicated to his Majesty, and is lying "under consideration before the Lords of the Admiralty."

London Mechanics' Register.

HYDROSTATIC PISTON.

Contrived by Mr. Augustus Day, of Philadelphia.



Description of the Engraving.

A and B represent two wooden or metallic plates, of circular form, and rather less diameter than the calibre of the cylinder in which they are designed to move.

C, A metallic hoop or band passing round A, to secure the flexible leather or canvass, represented at D, which has been previously fastened to the plate, B.

EE, Bolts passing through the plates A

and B, for the adjustment of the piston, so as to make it fit the cylinder.

F, a tubular piston rod.

Now, if water or any other liquid be introduced between the plates, through the piston, and the piston itself be partially or wholly filled, it is evident that the leather shown at D will be pressed outwards and against the sides of any required cylinder, with a force equal to the weight of the liquid column.

A small lateral pressure in this way will be found competent to maintain a tight movement in the piston, while the friction need not be very great.

The situations in which this piston can be used to advantage appear to be few; it was designed, and, in fact, applied by Mr. Day, as a moveable head to draught casks containing fermented liquors, with a view to prevent the admission of atmospheric air into the cask, while *on tap*. The rod moved through guides, and water and weights were placed on the upper surface of the piston head. It might be applied to large bellows, and perhaps to large pumps.

The contrivance is simple and ingenious, like many other useful improvements emenating from the same source.—Ed.

BUYING WIVES.

The Babylonians had a law, which was also followed by the Heneti, an Illyrian people, and by Herodotus thought to be one of their best, which ordained that when girls were of a marriageable age, they were to repair at a certain time to a place where the young men likewise assembled. They were then sold by the public crier, who first disposed of the most beautiful one. When he had sold her, he put up others to sale, according to their degrees of beauty. The rich Babylonians were emulous to carry off the finest women, who were sold to the highest bidders. But as the young men who were poor could not aspire to have a fine woman, they were content to take the ugliest, with the money which was given with them; for when the crier had sold the handsomest, he ordered the ugliest of all the women to be brought, and inquired if any person was willing to take her with a small sum of money? Thus she became the wife of him who was most easily satisfied; and thus the finest women were sold, and that from the money which they brought, small fortunes were given to the ugliest, and to those who had any bodily deformity. A father could not marry his daughter as he pleased, nor was he who bought her allowed to take her home, without giving security that he would marry her. But, after the sale, if the parties were not agreeable to each other, the law enjoined that the purchase money should be restored.

ANOTHER WAY OF MATCH MAKING.

Amongst the Cretans, the young men, when of mature age, were not permitted to marry as they thought fit themselves.—They were not left to the impulse of passion, by which we are so frequently misled in that serious engagement. In forming the contract of wedlock, riches and pleasures were not their objects—those delusive phantoms, which often bring discord, indifference, and regret. In truth, a Cretan married not for himself, but for the State. The Magistrates had the right of choosing the strongest and best made of the young men, and of marrying them to women who resembled them in constitution and figure, that a well proportioned matrimonial union might produce a robust, tall, well-made posterity, whose physical powers would do honour to the nation, defend it, terrify their enemies by their mere presence, and conquer and reduce them to subjection bytheir strength and their valor.

Singular adventure which befel Dr. Clarke, *in passing one of the Baths at Athens.*

From the additional volume of Clarke's Travels.

The following day was attended by a singular adventure. We had agreed to spend the greater part of the day with Lusieri, among the antiquities of the citadel; and for this purpose Mr. Cripps accompanied him to the Acropolis soon after breakfast. The author followed towards noon. About half way up the steep which leads to Propylæ, he heard a noise of laughter and many clamorous voices, proceeding from a building situated in an area upon the left hand, which had the appearance of being a public bath. As it is always customary for strangers to mingle with the Mahometans in such places, without molestation, and as it had been the author's practice to bathe frequently for the

preservation of his health, he advanced without farther consideration towards the entrance, which he found to be covered with a carpet hanging before it. Not a human creature was to be seen without the bath whether Turk or Greek. This was rather remarkable; but is seemed to be explained in the numbers who were heard talking within. As the author drew nigh unto the door of the building, the voices were heard in a shriller tone than usual; but no suspicion entered into his mind as to the sort of bathers he would find assembled, he put aside the carpet, and stepping beneath the main door of the bagnio, suddenly found himself in the midst of the principal women of Athens, many of whom were unveiled in every sense of the term, and all of them in utter amazement at the madness of the intrusion. The first impulse of astonishment entirely superseded all thought of the danger of his situation; he remained fixed and mute as a statue. A general shriek soon brought him to his recollection. Several black female slaves ran towards him, interposing before his face napkins, and driving him backwards towards the entrance. He endeavoured by signs and broken sentences, to convince them that he came there to bathe in the ordinary way; but this awkward attempt at an apology converted their fears into laughter, accompanied by sounds of Hist! Hist! and the most eager entreaties to him to abscond quickly, and without observation. As he drew back, he distinctly heard some one say in Italian, that if he were seen he would be shot. By this time the negro women were all around him, covering his eyes with their hands and towels, and rather impeding his retreat, by pushing him blindfolded towards the door, whence he fled with all possible expedition.

As the sight of women in Turkey is rare, and always obtained with difficulty, the reader may perhaps wish to know what sort of beings the author saw during the short interval that his eyes were open within the bagnio; although he can only describe the scene from a confused recollection. Upon the left hand, as he entered, there was an elderly female, who appeared to be of considerable rank, from the number of slaves sumptuously clad and in waiting upon her. She was reclined, as is usual in all Turkish baths, upon a sort of divan, or raised floor, surrounding the circular hall of the bath, smoking and drinking coffee. A rich embroidered covering of green silk had been spread over her. Her slaves stood by her side upon the marble pavement of the bath.—Many other women of different ages were seated, or standing, or lying, upon the same divan. Some appeared coming in high wooden clogs from the sudatories or interior chambers of the bath, towards the divan; their long hair hanging dishevelled and straight, almost to the ground; the temperature of those cells had flushed a warm glow seldom seen upon the pale and faded cheeks of the Grecian and Turkish women. Some of them were very handsome. Within the centre of the area, immediately beneath the dome, the black women and other attendants of the bath were busied bearing towels, and preparing pipes and coffee for the bathers; according to the custom observed when men frequent these places.

The cause of this mistake remains now to be explained. This bath was not peculiarly set apart for the use of females; it was frequented also by the male inhabitants; but at stated hours the women have the privilege of appropriating it to their use; and this happened to be their time of bathing; consequently, the men were absent. Upon such occasions, the Greek and Turkish women bathe together; owing to this circumstance, the news of the adventure was very speedily circulated all over Athens. As he did not return until the evening, the family with whom he resided, hearing of the affair, began to be uneasy, lest it had been brought to a serious termination, well knowing that if any of the Arnauts, or of the Turkish guard belonging to the citadel, had seen a man coming from the bath while the women were there, they without hesitation or ceremony would have put him instantly to death; and the only reason we could assign for its never having been afterwards noticed was, that however generally it became the subject of conversation among the Turkish females of the city, their Mahometan masters were kept in ignorance of the transaction.

POLYGAMY.

From Sir J. Macintosh's Account of the Population of Bombay.

One of the most curious results which these documents afford is that relating to the proportions of the two sexes, and to the extent in which polygamy prevails in India. A philosopher (Montesquieu) misled by travellers, too much disposed to make general inferences from a few pecu-

liar cases, and pleased to discover a seeming solution of the repugnant system of domestic life adopted in Europe and in Asia, supposes the polygamy of eastern nations to be the natural consequence of the superabundance of women produced in warm climates. Mr. Bruce attempts to support this theory by a statement of a most extraordinary nature. According to him, in Mesopotamia, Armenia, and Syria, the proportion of births is two women (and a fraction) to one man; from Fatakia to Sidon it is two and three fourths to one man; from Suez to the straits of Babelmandel the proportion is fully four to one man, which he believes holds as far as the line, and 302 beyond it. But facts are directly opposed to this statement. By the report of Mr. Ravenshaw, contained in the very instructive travels of Dr. Francis Buchanan, we learn that in the southern part of the province of Canara the whole number of the inhabitants was 896,672, of whom the males were 206,633, the females 190,039. The same excess of males above females is, he tells us, to be found in the Barra Mahl, and other parts of the Peninsula where accurate enumerations have been made. The return of deaths in the island of Bombay, for nearly eight years, establishes the same fact with respect to the whole population, and to each of the classes which compose it.

It is well known that the Mahometans are the only class of men in India who practise polygamy to any considerable extent. Out of 20,000 Mahometans in the island of Bombay, only about 100 have two wives, and only five have three; so inconsiderable is the immediate practical result of a system which, in its principles and indirect consequences, produces more evil than perhaps any other human institution, so insignificant is the number of those for whose imagined gratification so immense a body of reasonable beings are degraded and enslaved.

It is remarkable that the only apparent superiority of the number of females is in some of the returns of the Chsistian congregations, where polygamy is of course unknown. It is reasonable to refer this small exception to accidental causes, which inquiry will probably discover.

POWERFUL EFFECTS OF CHARCOAL.

The destructive nature of the vapour of charcoal in a close room is well known; many have perished by it. It is more dangerous, inasmuch as it produces no bad smell to notify its approach, but steals on by little and little, bringing on a gradual faintness without any manifest or perceptible suffocation. It is told of some Dutchmen who wintered in Nova Zembla, that in collecting materials for a fire, they gathered some charcoal, or, as the narrative, "sea coal." At first they felt much refreshed by the heat, but after a little time a general silence grew upon them as they sat round the fire, which was succeeded by a general reluctance to converse any farther; immediately after, one of them, the weakest, fell into a swoon, and a short time after another fainted; on this a suspicion arose as to the cause of the general torpid state of the company; one of them opened the door to admit air to the men who had swooned; this was no sooner done than the entire party recovered the freedom of respiration and former state of spirits. The torpid effect appears to have been produced by the inspissation or thickening of the air by the vapour of the charcoal, and the consequent inspissation of the breath and of the spirits. The son of a celebrated chemist on the continent killed himself a few years ago, by voluntarily locking himself up in a close room, lighting a fire of charcoal, and inhaling the vapour of it; he was so calm and philosophical in his act of self-destruction, that he placed his watch, with paper, pen and ink, on the table, by which he sat and noted down in writing the progressive effects caused by the vapour on his system, every advancing half minute. On bursting open the door, he was found dead on the chair, the written observations concluded by an illegible scrawl,

which he was supposed to have written the moment before he became quite insensible, and to have been unable to write in an intelligible form, by the actual stupefaction of his faculties.

FRENCH AND ENGLISH GUNPOWDER.

By a report lately made to the Minister of War in France, it appears that the best powder made in that country is composed as follows: In 100 parts 78.00 saltpetre, 12.88 charcoal, 9.12 sulphur. The best Dartford powder contains 79.70 saltpetre, 12.48 charcoal, 7.82 sulphur. A *litre* of the former weighs 905 grammes, while a *litre* of the latter only weighs 857. The difference of density is occasioned by being subjected in the manufacture, to different degrees of pressure; and it is stated by the French chemists, that the more dense the powder, so as not to check the combustion, the better. The strength of the French powder of this density is considerably greater than English powder; but reduced to the same density they are nearly equal. But the French powder with which these experiments were made, was the patent powder of M. Bouchet; and prior to his improvements, the best powder in France, was 3-20ths less strong than that made in England. The comparison was made with Dartford powder; we believe, however, that a still stronger powder was for a short time made in England.

POPULAR INSTRUCTION.

The various mechanical institutions, which within these few years have been established in the different great towns of this empire, have justly attracted the attention and merited the applause of every enlightened patriot. These institutions promise in a short time to better, materially, the condition, and to increase the power, of the labouring classes. Nor is their political vigilance likely to be lessened by augmenting their intellectual and moral strength. Their knowledge of their civil rights must keep pace with the general improvement of their minds; and as they rise in the scale of society, they must acquire that commanding influence which their new relative position is calculated to confer. As the people become more intelligent, they are less liable to be misled—superstitious errors loose their hold—quackery is hooted out of existence—the power of demagogues is annihilated—mobs and tumults, occasioned by knavery working upon ignorance, are at an end—and as the great mass of society cannot be moved but when their rights and priviliges are in real danger, their union and zeal on such occasions must render their strength irresistible. The government of France does not entertain the same opinion on these subjects as we have above expressed, and therefore M. de Corbiere, the Minister of the interior, has, in his wisdom, suppressed all the schools of mutual instruction, which had been established by benevolent societies or individuals. But there is one institution, similar in its object, though not in its origin or regulations, to our Mechanical Institutes, which has been allowed still to exist—namely, the public lectures at the *Conversatoire des Arts et Metiers*. In the amphitheatre or lecture room of that establishment, a course of popular instruction is given in Political Economy, in Geometry, and Mechanical Philosophy applied to the Arts, and in Chemistry applied to manufactures. It is enough in praise of the manner in which these courses of lectures are conducted, to state, that the first is given by M. Say, one of the first political economists of Europe; the second by M.C. Dupin, the author of the *Voyages en Grande Bretagne*; and the third by M. Clement, a well known practical chemist. M. Dupin, whose publications we are always ready to welcome with pleasure, and whose activity of mind is such that he seldom allows the public long to forget him, has just published his introductory discourse to this year's prelections. Like all the other productions of the same author, this little work is distinguished by extent of information, elegance

of diction, and liberality of views.—M. Dupin is calculated to be a great benefactor to his countrymen, by introducing among them a knowledge of those mechanical arts in which we are their superiors—by explaining to them the causes of our superiority—by boldly informing them of the instances in which they must yield the palm to their neighbours—by converting their feelings of narrow jealousy into a sentiment of generous rivalship—in short, by liberalizing as well as instructing their minds, with regard to the scientific progress and mechanical improvements of other nations. M. Dupin reasons strongly in favour of instructing the industrious portion of society, and enforces his arguments by a reference to the state of knowledge among English and Scotch mechanics, and the advantages derived from it in the improvement of the arts. "I will tell those men," says he, "who see nothing but mere machines in the laborious classes, that I know a machine more powerful than that of Watt—more ingenious than that of Arkwright, and greatly more susceptible of improvement. The whole universe does not contain twenty thousand of Watt's machines, nor ten thousand of those of Arkwright; but the kind of machine to which I allude is multiplied on the face of the globe a thousand million of times. The steam engines of the whole world do not represent a force greater than that of four hundred thousand horses; and I know one which represents the force of one hundred million of horses! What then is this machine? Must I mention it in adopting the degrading language of some persons? It is man." We shall not enter farther into this ingenious and liberal paper than by citing the following passage:

"In abusing England, we have sometimes heard it affirmed that she gained her victories by her treasures, which subsidized nations against us, rather than by the valour of her own defenders. But, in the first place, this is to avow that gold is even military force; and how did England acquire this gold? Did she draw it from her mines? No: she has no mines which produce gold. Did she extort it from conquered nations in her transmarine possessions? Never did India or America, by their tributes or spoils, enrich the public treasury of Great Britian. What then in all times has been the source of her riches? The industry of her people, and the labour which is its element. We must admit that 14,000,000 of English and Scotch possess greater industry, and produce more commodities, than 30,000,000 or 40,000,000 of the nations of the continent. This is the reason why 14,000,000 of Scotch and English have been able to struggle with advantage during peace and war against more numerous adversaries. Far from us be those vain declamations of writers and orators, who sacrifice truth to popularity in our assemblies, our saloons, and our workshops—who tell us perpetually of our superiority—who perpetually ring in our ears that we are the first people on earth. Doubtless we have every thing requisite to become so; but at the present moment, far from being in the first rank, I fear we are far, far distanced by England. England has arrived at a remarkable epoch, which prepares for her new destinies, and greater prosperity than she has ever before attained in peace or war."

We hear that M. Dupin has been made a Baron, and a Member of the Legion of Honour, by the new king. We hope that the liberality as well as the talent of his publication, had its due weight in procuring for their author these honorary distinctions.

London Mechanic's Register.

Among the present exhibitions at Paris, is that of a human fossil which was found near Moret, in the department of the Seine and Marne.

Communications for the American Mechanics' Magazine, post paid, and addressed to J. V Seaman, New-York, will receive due attention.